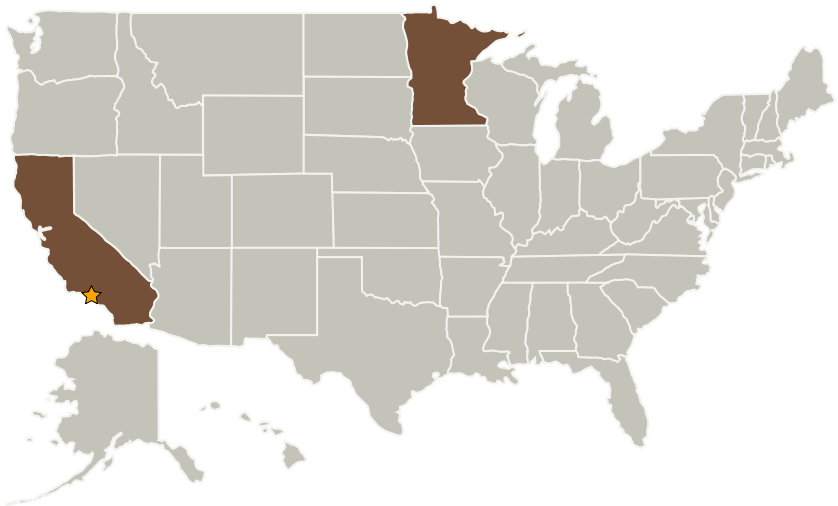
# Integrated Production of Ultra-Low Defect GaN Films and Devices for High-Power Amplifiers, Phase I

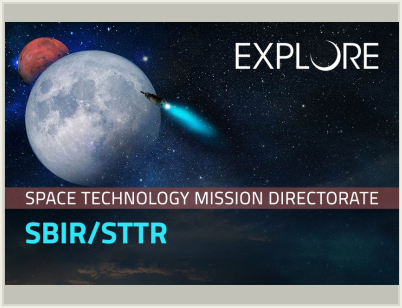
Completed Technology Project (2008 - 2008)

## Project Introduction

High quality GaN epitaxial films are key to current efforts for development of both high-power/high-speed electronic devices and optoelectronic devices. In fact, solid state lighting, high-temperature and high-power electronics, microelectronic and mechanical sensors, and high-efficiency solar cells are all poised at a new level of development. This enormous market is waiting for low-cost, high quality substrates to achieve performance and fabrication economies of scale. This NASA SBIR phase I project addresses the development of a dislocation filter that can routinely prepare low-stress GaN thin films with threading dislocation densities below 1E7 cm-2. The method relies on using a low-angle ion beam to induce both nanofilter for defect reductions and to inhibit droplet formation at low growth temperatures. Dislocation densities have so far been determined by standard etch pit densities method. The goal the project to optimize the defect nanofilter to reduce the TD to less than 1E6 cm-2. To obtain a more practical evaluation of the effectiveness and commercial viability of the method, heterojunction field effect transistors with high electron mobility will be fabricated in these ultra-low defect density films. These high-quality material based high electron mobility transistors (HEMTs) will enable high linearity power amplifiers with excellent thermal stability and frequency response. A plus would be if these were compatible with the mature silicon technology that is already in place. The new method to fabricate GaN-based high-performance devices on low defect substrates would be scalable to large area wafers, allowing the technology to be economical. The proposed method to grow on low-stress, low-dislocation density films will lead to the production of electronic devices of unparalleled performance.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Jet Propulsion Laboratory (JPL)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ★Jet Propulsion Laboratory(JPL) | Lead Organization | NASA Center | Pasadena, California |
| SVT Associates | Supporting Organization | Industry | Eden Prairie, Minnesota |

| Primary U.S. Work Locations | |
|---|---|
| California | Minnesota |

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Bentao Cui

## Technology Areas

**Primary:**

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes